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**LEAP WIRELESS
SENSOR SYSTEM**

**REFRIGERATOR AND
FREEZER**

**TEMPERATURE &
OPTIONAL DOOR-OPEN
SENSOR NODE
USER MANUAL**

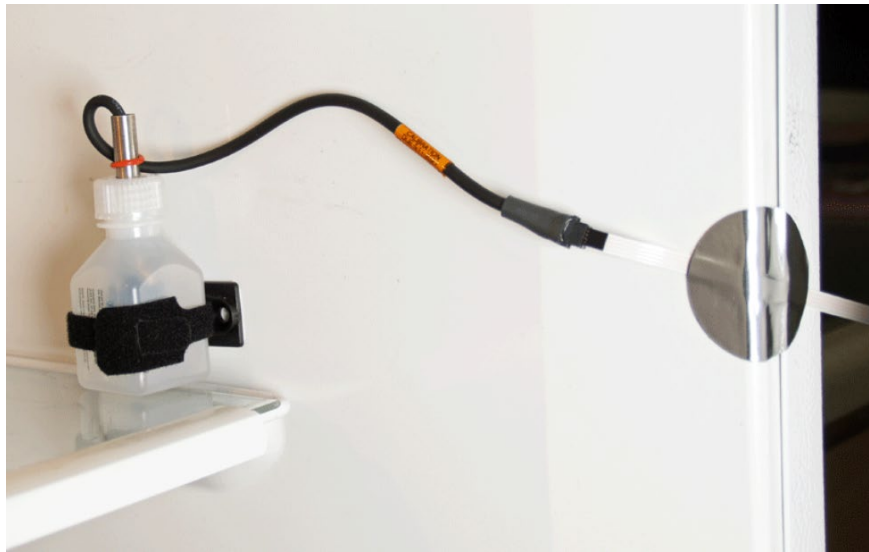
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1. Thermal Buffer Bottle Purpose



1.1 Why Liquid Thermal Buffers Are Used with Refrigerator and Freezer Temperature Probes

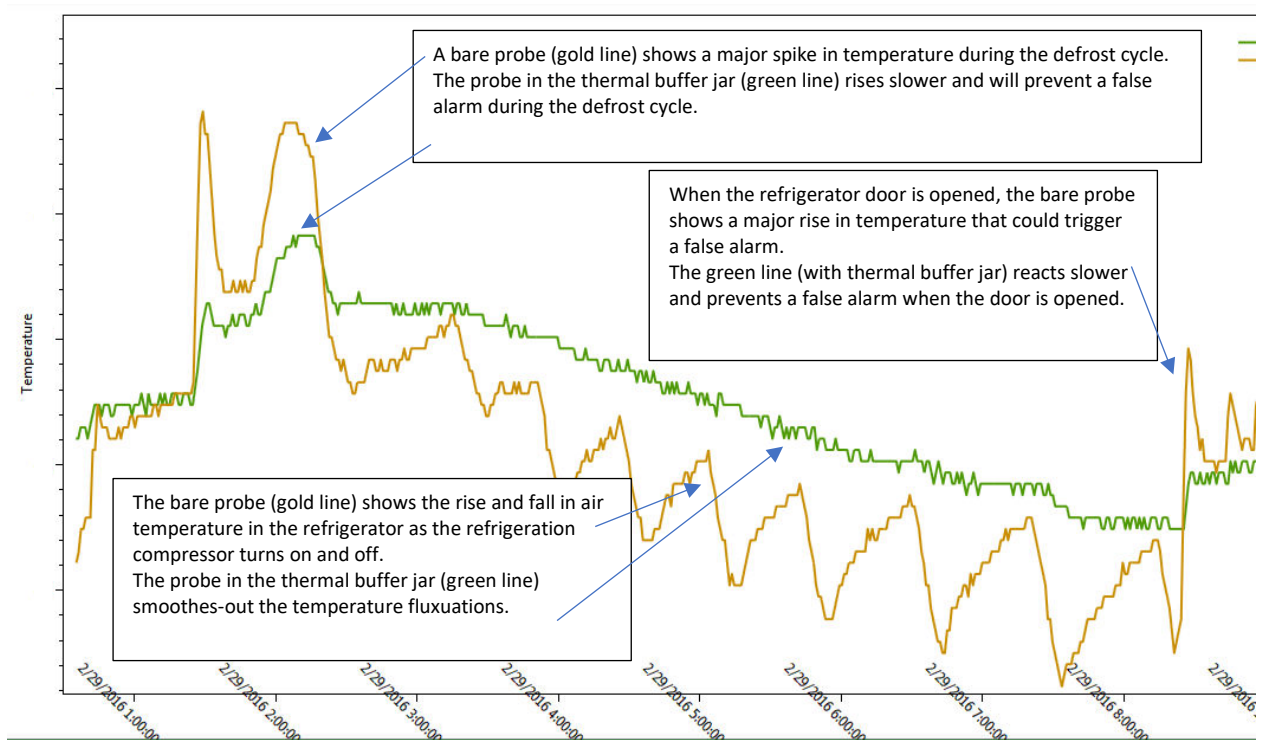
When monitoring refrigerators and freezers it is common practice to use a jar of liquid to dampen the rise in temperature that the temperature probe sees during the normal defrost cycle or when the door is opened. Without the thermal buffer, the temperature monitoring system will be prone to send inappropriate high-temperature alarms during defrost cycles and when the door is opened.

The Center for Disease Control (CDC) recommends this type of “liquid thermal buffering” when doing temperature monitoring of vaccine refrigerators. This type of liquid thermal buffer is also often used when conducting audits on refrigerators and freezers in commercial food operations. Liquids are used as thermal buffers in refrigerators because the liquid changes temperature slowly and emulates the temperature change that food in the refrigerator (or freezer) experience.

The thermal mass of the liquid will slow-down the response time of the temperature sensor and will prevent false alarms. If the door is open for several minutes, this will be enough time for the liquid to heat-up and for the probe to detect an alarm condition.

1.1.1 Effect of a Liquid Thermal Buffer Jar

The graph below shows the effect of the liquid thermal buffer jar by comparing a bare probe with a probe that is in the jar.



1.2 The Polypropylene Glycol - Water Liquid

The liquid in the jar is 40% water and 60% polypropylene glycol USP. The polypropylene glycol prevents freezing of the liquid so that the jar can be used down to -25F in a freezer. Polypropylene glycol is often used as an additive in some foods.

A Material Safety Data Sheet (MSDS) sheet for the Propylene Glycol USP (CAS No. 57-55-6) may be downloaded from the internet at: <http://www.chemworld.com/v/vspfiles/assets/images/SDS-CHEMWORLD-PGUSP.pdf>

2. Installing the System Components

2.1 Prepare the Jar for the Temperature Probe

The thermal buffer jars are shipped with a normal cap. Remove the cap and install the cap that contains the sealed metal tube into the bottle.

2.2 Attaching the Jar Inside the Refrigerator

Typically, the thermal buffer jar is installed on the hinge-side of the refrigerator to make cable routing easy.

Use a wet wipe to clean the surface inside the refrigerator where the thermal buffer jar will be located. Let the area dry. It may be necessary to use a dry wipe or paper towel to remove frozen condensation from the area.

When the area where you want to mount the bottle is clean, free of frozen condensation, and dry – remove the paper backing from the adhesive mount and press the adhesive to the side of the refrigerator.

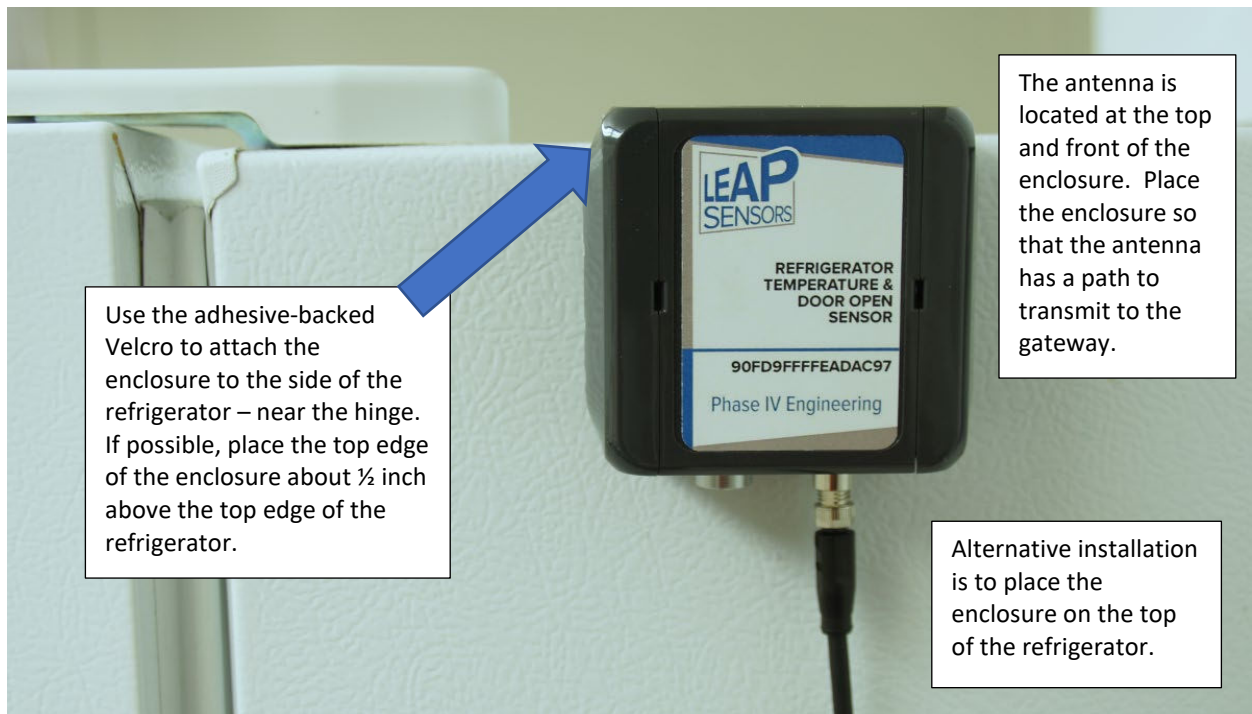


2.3 Attach Transceiver Device Node to Side of Refrigerator

Typically the refrigerator device node enclosure is mounted on the side of the refrigerator, at the top edge, near the hinge. Clean the area where it will be mounted with a wet wipe.



Clean the back of the device node with the wet wipe.



Un-wind the temperature sensor flat cable and flatten and straighten the cable to the temperature sensor.

Route the probe and wire into the refrigerator through the hinge.
Remove the o-ring from the metal tube.
Place the probe all the way down into the metal tube.

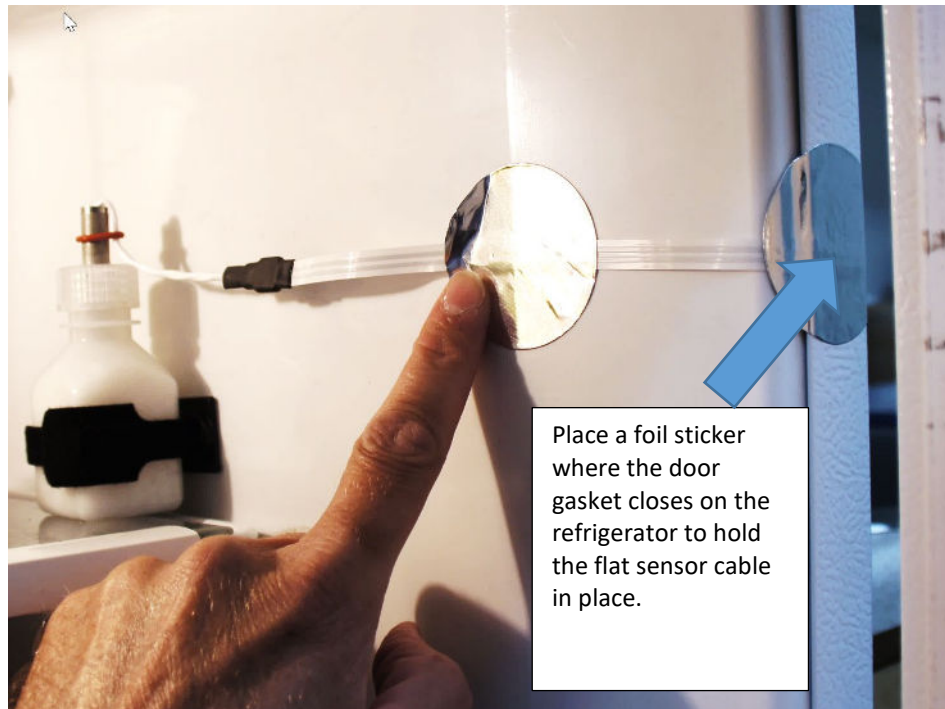


Place the o-ring over the wire to keep the wire from pulling the probe out of the jar.



Use the special cold-temperature foil stickers to route the cable out of the refrigerator.

Place the foil sticker in the refrigerator to help route the wire out to the sensor module.



Place additional foil stickers on the outside of the refrigerator to route the wire to the outside.



Extra cable may be folded-up and attached to the side of the refrigerator with foil stickers. It will not harm the thin cable to fold it.



Extra cable may be folded and kept in place with a foil sticker.

3. Optional Door-Open Sensor

3.1 Installing the Door-Open Sensor

The door open sensor works best when it is installed on the side of the door that opens (not the hinge side).

The door-open switch activates when the two parts are more than about ½ inch apart from each other.

The air-gap between the sensors keeps them from being knocked-off when the door is pressed closed.

Select the location of the door sensor. Clean the area with a wet wipe.

Remove the backing from the high-strength adhesive tape on the door switches.

NOTE: The sensors can be repositioned after they are first installed, but the adhesive will gain strength over time.

To achieve the proper spacing between the switches, use the supplied spacer to install the door-open sensors as shown below.



Route the cable to the device node enclosure and install the cable to the panel connector on the enclosure.

Use the foil stickers to hold the cables in-place

3.2 How the Door-Open Switch Operates – and Collects Data

3.2.1 Taking Data and Transmitting

The device node will always take temperature and door-open sensor readings at the time interval set in the Leap software. This is set by selecting the device, clicking on “Configure Device” then scrolling down to “Device Settings”. The sensor below is set with a sample and transmit interval of every 1 minute. Typically sample and transmit intervals of 10 to 15 minutes work well for refrigerators. This allows the battery to last many years.

Intervals

Transmit Interval

Days	Hours	Minutes	Seconds
0	00	01	00

Sampling Interval

Days	Hours	Minutes	Seconds
0	00	01	00

Software display:

Device ID	Temperature	Door Open (0)/Closed (1)	Door Open Time (sec)
000D6FFFFE3AAFA9	74.05 °F	0	150
Last Communicated: 4/1/21 1:31:27 PM MDT Last Reading: 4/1/21 1:31:17 PM MDT Firmware Version: 1.00 Battery: 3.199V Signal: -61			
000D6FFFFE3CE2A6	74.35 °F	1	0
Last Communicated: 4/1/21 1:31:26 PM MDT Last Reading: 4/1/21 1:31:22 PM MDT Firmware Version: 1.00 Battery: 3.201V Signal: -58			

3.2.2 Sample and Transmit on Door Open and Door Close

In addition to sampling and transmitting on a time interval (as shown above), if the device has a door-open sensor installed, it will sample and transmit data every time the door is open and when the door is closed.

Data will be collected showing how long the door was open.

See a download of the data below:

	DeviceId	Name	Reading Timestamp (MDT)	Received Timestamp (MDT)	Temperature (°F)	Door Open (0)/Closed (1)	Door Open Time (sec)
36	000D6FFFFE3CE2A6		4/2/2021 5:46	4/2/2021 5:47	38.05	0	26624
37	000D6FFFFE3CE2A6		4/2/2021 5:56	4/2/2021 5:57	40.33	0	27224
38	000D6FFFFE3CE2A6		4/2/2021 6:06	4/2/2021 6:07	42.44	0	27824
39	000D6FFFFE3CE2A6		4/2/2021 6:15	4/2/2021 6:17	43.54	0	28424
40	000D6FFFFE3CE2A6		4/2/2021 6:23	4/2/2021 6:23	42.53	1	28892
41	000D6FFFFE3CE2A6		4/2/2021 6:23	4/2/2021 6:23	42.46	0	0
42	000D6FFFFE3CE2A6		4/2/2021 6:23	4/2/2021 6:24	42.42	1	5
43	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	42.33	0	0
44	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	42.24	1	9
45	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	42.15	0	0
46	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	42.03	1	15
47	000D6FFFFE3CE2A6		4/2/2021 6:24	4/2/2021 6:24	41.85	0	0
48	000D6FFFFE3CE2A6		4/2/2021 6:27	4/2/2021 6:27	40.59	1	131
49	000D6FFFFE3CE2A6						

When the door is either open or closed (and not changing) the normal transmit interval is every 10 minutes for this device.

Not Changing

After a long time of the door being open, the door is closed at 6:23

Every time the door is open and closed, a reading is taken and the data is transmitted.

Data is transmitted every time the door is open or closed.

3.2.3 Door Open Alerts

Alerts may be set on the door open sensor and also the Door Open Time in the alerts section of the software.

- End of Document -

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